Claims

43. A method for selectively removing at least one biological contaminant from a selected compound, the method comprising:

(a) directing a first fluid stream having a selected pH and including at least one biological contaminant and a selected compound, so as to flow along a first selective membrane;

(b) directing a second fluid stream along the first selective membrane so as to be isolated from the first fluid stream thereby;

(c) applying at least one voltage potential across each of the first and second fluid streams, wherein the application of such voltage potential causes movement of at least a portion of a selected one of the at least one biological contaminant and the selected compound though the first selective membrane into the second fluid stream such that the other of the at least one biological contaminant and the selected compound is substantially prevented from entering the second fluid stream, and wherein substantially all transmembrane migration of the selected one of the at least one biological contaminant and the compound is initiated by the application of the voltage potential; and

(d) maintaining step (c) until at least one of the fluid streams contains the desired purity of the compound.

44. The method according to claim 43 further comprising

directing a third fluid stream separated from a selected one of the first and second fluid streams by a second selective membrane,;

applying concurrently the voltage potential across the third fluid stream so as to cause migration of at least a portion of at least one of the compound and the biological contaminants into the third fluid stream;

directing a fourth fluid stream separating from the other of the first and second fluid streams by a third selective membrane; and

applying concurrently the voltage potential across the fourth fluid stream so as to cause migration of at least a portion of at least one of the compound and the biological contaminants into the fourth fluid stream.

45. The method according to claim 43 wherein the method further comprises periodically stopping and reversing the voltage potential to cause movement of at least any components of the first fluid stream having entered the selective membrane to move back into the first fluid stream and wherein substantially not causing any of selected one of the biological contaminants and the compounds that have entered the second fluid stream to re-enter the first fluid stream.

46. The method according to claim 43 wherein the compound is selected from the group consisting of blood proteins, immunoglobulins, recombinant proteins, and combinations thereof.

47. The method according to claim 43 wherein the biological contaminant is selected from the group consisting of viruses, bacteria, prions, yeast, lipopolysacchrides, toxins, endotoxins, and combinations thereof.

48. The method according to claim 43 wherein step (d) results in the compound being substantially free of biological contaminants.

49. A method for concurrently isolating both a selected compound and at least one biological contaminant from a fluid stream, the method comprising:

(a) directing a first fluid stream having a selected pH and including at least one biological contaminant and a selected compound, so as to flow along a first selective membrane;

(b) directing a second fluid stream along the first selective membrane so as to be isolated from the first fluid stream thereby;

(c) directing a third fluid stream separated from the first fluid stream by a second selective membrane;

(d) applying concurrently at least one voltage potential across each of the first, second and third fluid streams, wherein the application of such voltage potential causes movement of at least the selected compound though the first selective membrane into the second fluid stream such that at least a portion of the biological contaminant is prevented

from entering the second fluid stream and causes movement of at least a portion the biological contaminant remaining in the first fluid stream through the second selective membrane into the third fluid stream; and

(e) maintaining step (d) until at least one of the fluid stream contains the desired purity of the selected compound.

50. The method according to claim 49 wherein the method further comprises directing a fourth fluid stream separated from the second fluid stream by a third selective membrane and concurrently applying the voltage potential across the fourth fluid stream so as to cause the selective migration of at least one of any biological contaminants which have entered the second fluid stream and other components in the second fluid stream through the third selective membrane into the fourth fluid stream.

51. The method according to claim 49 wherein the method further comprises periodically stopping and reversing the voltage potential to cause movement of at least any components of the first fluid stream having entered the first selective membrane to move back into the first fluid stream and wherein substantially not causing any of the selected compound that has entered the second fluid stream to re-enter the first fluid stream.

52. The method according to claim 49 wherein the first fluid stream further includes a compound from which the selected compound is separated, wherein such compound is selected from the group consisting of blood proteins, immunoglobulins, recombinant proteins, and combinations thereof.

53. The method according to claim 49 wherein the biological contaminant is selected from the group consisting of viruses, bacteria, prions, yeast, lipopolysaccharides, toxins, endotoxins, and combinations thereof.

54. The method according to claim 49 wherein the pH of the first fluid stream is selected by selectively adding a buffer having the required pH.

55. The method according to claim 52 wherein the first fluid stream has a pH selected at one of a pH lower than the isoelectric point of the compound, a pH about the isoelectric point of the compound, and a pH higher than the isoelectric point of the compound.

56. The method according to claim 49 wherein the first selective membrane has a molecular mass cut-off of at least about 3 kDa.

57. A method for concurrently isolating both a selected compound and at least one biological contaminant from a fluid stream, the method comprising:

(a) directing a first fluid stream having a selected pH and including at least one biological contaminant and a selected compound so as to flow along a first selective membrane;

(b) directing a second fluid stream along the first selective membrane so as to be isolated from the first fluid stream thereby;

(c) directing a third fluid stream separated from the second fluid stream by a second selective membrane;

(d) applying concurrently at least one voltage potential across each of the first, second and third fluid streams, wherein the application of such voltage potential causes movement of at least one of the selected compound and biological contaminant though the first selective membrane into the second fluid stream and causes selected migration of at least a portion of at least one of the selected compound and the biological contaminant having entered the second fluid stream through the second selective membrane into the third fluid stream; and

(e) maintaining step (d) until at least one of the fluid stream contains the desired purity of the selected compound.

58. The method according to claim 57 wherein the method further comprises directing a fourth fluid stream separated from the first fluid stream by a third selective membrane and concurrently applying the voltage potential across a fourth fluid stream so as to cause selective migration of at least one of any biological contaminants which have remained in the first fluid

stream and any other components in the first fluid stream through the third selective membrane into the fourth fluid stream.

59. The method according to claim 57 wherein the method further comprises periodically stopping and reversing the voltage potential to cause movement of any components of the first fluid stream having entered the first selective membrane to move back into the first fluid stream and wherein substantially not causing any of the selected compound and biological contaminant that have entered the second fluid stream to re-enter the first fluid stream.

60. The method according to claim 57 wherein the first fluid stream further includes a compound from which the selected compound is separated, wherein such compound is selected from the group consisting of blood proteins, immunoglobulins, recombinant proteins, and combinations thereof.

61. The method according to claim 57 wherein the biological contaminant is selected from the group consisting of viruses, bacteria, prions, yeast, lipopolysaccharides, toxins, endotoxins, and combinations thereof.

62. The method according to claim 57 wherein the pH of the first fluid stream is selected by selectively adding a buffer having the required pH.

63. The method according to claim 60 wherein the first fluid stream has a pH selected at one of a pH lower than the isoelectric point of the compound, a pH about the isoelectric point of the compound, and a pH higher than the isoelectric point of the compound.

64. The method according to claim 57 wherein the first selective membrane has a molecular mass cut-off of at least about 3 kDa.

65. A method for concurrently isolating both a selected compound and at least one biological contaminant from a fluid stream, the method comprising:

(a) directing a first fluid stream having a selected pH and including at least one biological contaminant and a selected compound so as to flow along a first selective membrane;

(b) directing a second fluid stream along the first selective membrane so as to be isolated from the first fluid stream thereby;

(c) directing a third fluid stream separated from first fluid stream by a second selective membrane;

(d) applying concurrently at least one voltage potential across each of the first, second and third fluid streams, wherein the application of such voltage potential causes movement of at least a portion of the biological contaminant though the first selective membrane into the second fluid stream such that at least a portion of the selected compound is prevented from entering the second fluid stream and causes movement of at least a portion of at least one of the selected compound and any biological contaminant remaining in the first fluid stream through the second selective membrane into the third fluid stream; and

(e) maintaining step (d) until at least one of the fluid streams contain the desired purity of the selected compound.

66. The method according to claim 65 wherein the method further comprises directing a fourth fluid stream separated from the second fluid stream by a third selective membrane and concurrently applying the voltage potential across a fourth fluid stream so as to cause selected migration of at least a portion of any biological contaminants which have entered the second fluid stream through the third selective membrane and other components in the second fluid stream into the fourth fluid stream.

67. The method according to claim 65 wherein the method further comprises periodically stopping and reversing the voltage potential to cause movement of at least any components of the first fluid stream having entered the first selective membrane to move back into the first fluid stream and wherein substantially not causing any of the biological contaminants that have entered the second fluid stream to re-enter the first fluid stream.

68. The method according to claim 65 wherein the first fluid stream further includes a compound from which the selected compound is separated, wherein such compound is selected from the group consisting of blood proteins, immunoglobulins, recombinant proteins, and combinations thereof.

69. The method according to claim 65 wherein the biological contaminant is selected from the group consisting of viruses, bacteria, prions, yeast, lipopolysaccharides, toxins, endotoxins, and combinations thereof.

70. The method according to claim 65 wherein the pH of the first fluid stream is selected by selectively adding a buffer having the required pH.

71. The method according to claim 68 wherein the first fluid stream has a pH selected at one of a pH lower than the isoelectric point of the compound, a pH about the isoelectric point of the compound, and a pH higher than the isoelectric point of the compound.

72. The method according to claim 65 wherein the first selective membrane has a molecular mass cut-off of at least about 3 kDa.

73. A system for selectively removing at least one biological contaminant from a selected compound, the system comprising:

means for directing a first fluid stream having a selected pH and including at least at least one biological contaminant and a selected compound, so as to flow along a first selective membrane;

means for directing a second fluid stream along the first selective membrane so as to be isolated from the first fluid stream thereby; and

means for applying at least one voltage potential across each of the first and second fluid streams, wherein the application of such voltage potential causes movement of a selected one of the at least a portion of the at least one biological contaminant and the selected compound though the first selective membrane into the second fluid stream such that the other of the at least one biological contaminant and the selected compound is

substantially prevented from entering the second fluid stream, and wherein substantially all transmembrane migration of the at least one biological contaminant is initiated by the application of the voltage potential.

74. A system for concurrently isolating both a selected compound and at least one biological contaminant from a fluid stream, the system comprising:

means for directing a first fluid stream having a selected pH and including at least one biological contaminant and a selected compound so as to flow along a first selective membrane;

means for directing a second fluid stream along the first selective membrane so as to be isolated from the first fluid stream thereby;

means for directing a third fluid stream separated from the first fluid stream by a second selective membrane; and

means for applying concurrently at least one voltage potential across each of the first, second and third fluid streams, wherein the application of such voltage potential causes movement of the selected compound though the first selective membrane into the second fluid stream such that at least a portion of the biological contaminant is prevented from entering the second fluid stream and causes movement of at least a portion the biological contaminant remaining in the first fluid stream through the second selective membrane into the third fluid stream.

75. The system according to claim 74 wherein the system further comprises means for directing a fourth fluid stream separated from the second fluid stream by a third selective membrane and concurrently applying the voltage potential across the fourth fluid stream so as to cause the migration of any biological contaminants which have entered the second fluid stream through the third selective membrane into the fourth fluid stream.

76. A system for concurrently isolating both a selected compound and at least one biological contaminant from a fluid stream, the system comprising:

means for directing a first fluid stream having a selected pH and including at least one biological contaminant and a selected compound so as to flow along a first selective membrane;

means for directing a second fluid stream along the first selective membrane so as to be isolated from the first fluid stream thereby;

means for directing a third fluid stream separated from the second fluid stream by a second selective membrane; and

means for applying concurrently at least one voltage potential across each of the first, second and third fluid streams, wherein the application of such voltage potential causes movement of the selected compound and biological contaminant though the first selective membrane into the second fluid stream and causes movement of at least a portion of at least one of the selected compound and the biological contaminant having entered the second fluid stream through the second selective membrane into the third fluid stream.

77. The system according to claim 76 wherein the system further comprises means for directing a fourth fluid stream separated from the first fluid stream by a third selective membrane and concurrently applying the voltage potential across a fourth fluid stream so as to cause the migration of any biological contaminants which have remained in the first fluid stream through the third selective membrane into the fourth fluid stream.

78. A system for concurrently isolating both a selected compound and at least one biological contaminant from a fluid stream, the system comprising:

means for directing a first fluid stream having a selected pH and including at least one biological contaminant and a selected compound so as to flow along a first selective membrane;

means for directing a second fluid stream along the first selective membrane so as to be isolated from the first fluid stream thereby;

means for directing a third fluid stream separated from the first fluid stream by a second selective membrane; and

means for applying concurrently at least one voltage potential across each of the first, second and third fluid streams, wherein the application of such voltage potential causes movement of at least a portion of the biological contaminant though the first selective membrane into the second fluid stream such that at least a portion of the selected compound is prevented from entering the second fluid stream and causes movement of at least a portion of at least one of the selected compound and any biological contaminant remaining in the first fluid stream through the second selective membrane into the third fluid stream.

79. The system according to claim 78 wherein the system further comprises means for directing a fourth fluid stream separated from the second fluid stream by a third selective membrane and concurrently applying the voltage potential across a fourth fluid stream so as to cause the migration of at least a portion of any biological contaminants which have entered the second fluid stream through the third selective membrane into the fourth fluid stream.